



Factors Associated with Low Back Pain Among Pregnant Women in Padang, West Sumatra

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Abstract

Although low back pain is a common musculoskeletal complaint among pregnant women and is known to negatively affect their quality of life and daily activities, evidence regarding the factors influencing this condition remains limited. Therefore, this study aims to identify the factors associated with low back pain among pregnant women. This study used a cross-sectional study involved 111 pregnant women was selected using consecutive sampling at the Belimbing Public Health Center, Padang, West Sumatra. Data were collected through self-administered demographic questionnaire, Pregnancy Physical Activity Questionnaire (PPAQ), and the Roland Morris Disability Questionnaire (RMDQ), and BMI measurements. The results showed that the average low back pain score was 9.71, ranging from 3 to 20. Based on bivariate analysis using the Mann Whitney test, Kruskal Wallis test, and Spearman rank, it was found that there was a relationship between maternal age ($p=0.002$), gestational age ($p=0.017$), parity ($p<0.001$) with low back pain. Weight gain and physical activity were not related to low back pain, with ($p=0.062$) and ($p=0.140$), respectively. Low back pain in pregnant women is associated with maternal age, gestational age, and parity, whereas physical activity and body weight do not appear to have a significant relationship. Targeted education and simple preventive strategies may help reduce lower back pain during pregnancy.

Keywords: Low Back Pain, Pregnant Women, Musculoskeletal Pain

INTRODUCTION

Pregnant women experience numerous physical changes during pregnancy. Pelvic discomfort and lower back pain are common musculoskeletal complaints (Dudoniene & Kuisma, 2023). According to the World Health Organization (WHO), the prevalence of low back pain during pregnancy in Australia is reported to be 70%. The prevalence of low back pain ranges from 30% to 78% in the United States, Europe, and parts of Africa (Manyozo et al., 2019). In Indonesia, the prevalence of pregnant women experiencing low back pain (Fatmarizka et al., 2021).

Untreated low back pain increases the likelihood of postpartum back pain and chronic back pain, which are more challenging to treat or cure (Mota et al., 2015). Lower back pain that radiates to the pelvic area can make walking difficult, requiring crutches or other walking aids (Suryanti et al., 2021). Pregnant women with lower back pain may also experience difficulty standing, sitting, or getting out

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of bed (Mastiningsih & Aswitami, 2018). Similarly, a study by Manyozo et al. (2019) in Malawi reported that 43% of pregnant women with lower back pain experienced sleep disturbances, 24% had difficulty walking 100 yards (approximately 91 meters), 21% were unable to lift objects they previously could, 22% were unable to sit for more than 10 minutes, and 21% were unable to stand for more than 10 minutes.

Low back pain can be influenced by various risk factors (Carvalho et al., 2017; Yolandini et al., 2024). Associated risk factors include age (Amin & Novita, 2022; Arummega et al., 2022; Manyozo et al., 2019), gestational age (Amin & Novita, 2022; Berber & Satilmis, 2020; Manyozo et al., 2019), weight (Nazari et al., 2020), and occupation (Arummega et al., 2022; Sencan et al., 2018). Predisposing factors include changes in posture due to uterine growth, weight gain, the influence of the hormone relaxin, a history of previous pain, parity, and physical activity (Sencan et al., 2018). Several studies have shown that the incidence of low back pain increases as gestational age increases, particularly in the second and third trimesters (Arummega et al., 2022; Manyozo et al., 2019). Being overweight or obese has been shown to increase the risk of pain complaints. Overweight mothers tend to experience postural changes due to increased weight gain during pregnancy (Amayri et al., 2023; Amin & Novita, 2022). Furthermore, multiparity, poor exercise habits (Caputo et al., 2021; Dipietro et al., 2019; Manyozo et al., 2019; Osinuga et al., 2021), and heavy household chores also exacerbate this condition.

Data from the Padang City Health Office in 2023 showed that the most pregnant women resided in the Belimbing Community Health Center (Puskesmas) area. Based on initial observations and interviews with seven pregnant women, results showed that five of the seven experienced lower back pain. Five of the seven reported sitting or lying down more when the pain occurred. Five of the seven reported that the pain appeared suddenly and came and went. Two pregnant women were aged 36 and 38, four were in their third trimester, and two were in their second trimester. Three were pregnant with their second child, and two were pregnant with their third child. One of the seven had an overweight body mass index (BMI), and seven reported working as housewives.

Most studies on low back pain among pregnant women have primarily focused on biological and obstetric factors, such as maternal age, gestational age, body mass index (BMI), and parity. Physical activity has also been examined; however, it is often measured in general terms. In the Indonesian setting, women commonly experience dual roles, balancing employment and full responsibility for household tasks, where physical activity is largely dominated by domestic work rather than structured exercise. This context may contribute differently to the risk of low back pain, yet it has not been adequately captured in previous research. Therefore, there remains a gap in understanding how these five factors—maternal age, gestational age, BMI, parity, and context-specific physical activity—interact in influencing low back pain among pregnant women in Indonesia. This study aims to address this gap by examining these factors within a socio-cultural perspective.

METHODS

The Study Design

This study employed a cross-sectional design, which is commonly used to examine the relationship between risk factors and outcomes by collecting observational data at a single point in time. The dependent variable in this study was low back pain, while the independent variables included maternal age, gestational age, parity, body mass index (BMI), and physical activity.

Participants and setting

The study population consisted of all pregnant women who visited Belimbing Public Health Center, Padang. The sampling technique used was non-probability consecutive sampling, in which every eligible participant was enrolled sequentially until the required sample size was reached. All pregnant women who visited the Maternal and Child Health (KIA) clinic or participated in antenatal classes at Belimbing Public Health Center and met the inclusion criteria were invited to participate. The required sample size was calculated with the Lemeshow formula to be 101, and after adding 10% to account for potential dropouts, 111 respondents were included. Eligible participants were pregnant women in any trimester with a singleton pregnancy who attended antenatal visits or classes, while those with congenital spinal or pelvic disorders, multiple pregnancies, or severe nausea/vomiting were excluded.

Measures

Demographics

Demographic and obstetric data collected included maternal age (in years), gestational age (trimester), parity, body mass index (BMI), physical activity, and birth history. Additional background information, such as educational level, marital status, husband's education and occupation, were also obtained.

Maternal Body Mass Index (BMI)

Maternal body mass index (BMI) was assessed by measuring body weight using a calibrated weighing scale and height using a stadiometer. The BMI of pregnant women was classified into categories according to the Ministry of Health (2020) guidelines, along with the recommended weight gain during pregnancy.

Physical Activity Measurement

Physical activity during pregnancy was assessed using the Pregnancy Physical Activity Questionnaire (PPAQ), which is specifically designed to measure physical activity among pregnant women. The PPAQ consists of 36 items, of which 33 assess different activity domains, including transportation (3 items), sedentary behavior (3 items), household/caregiving (13 items), occupational activities (5 items), and sports/exercise (9 items) (Chasan-Taber et al., 2004).

Low Back Pain Measurement

Low back pain was assessed using the Roland Morris Disability Questionnaire (RMDQ), developed by Roland and Morris in 1983. The RMDQ consists of 24 items, each answered dichotomously ("yes" or "no") using a Guttman scale. Each "yes" response is scored as 1 and each "no" response as 0, resulting in a total score ranging from 0 to 24. Higher scores indicate greater pain-related disability and greater interference with daily activities (Stratford & Riddle, 2016).

Ethical Consideration

Approval was granted by the Ethical Committee of Faculty of Nursing, Universitas Andalas Number: 21.layaketik.KEPKFKEPUNAND. These included voluntary informed consent, respect for participant autonomy, privacy and confidentiality, and the right to withdraw from the study at any time without penalty.

Data Collection Procedure

Administrative and ethical approvals were obtained prior to the study. A research permit was granted by the Faculty of Nursing, Andalas University (20 September 2024), followed by registration with the West Sumatra Provincial DPM PTSP (21 September 2024) and submission of a permit to Belimbing

Primary Health Center (PHC), Padang City (24 September 2024). Ethical approval was obtained on 14 January 2025. A preliminary study involving seven pregnant women was conducted through interviews at Belimbing PHC on 4 November 2024. The main data collection took place from 17 January to 7 February 2025 in the Maternal and Child Health (MCH) room and during pregnancy classes. Questionnaires were distributed by the researcher, assisted by two trained enumerators who had been briefed on study procedures. Data were also collected during four pregnancy class sessions (22-25 January 2025). Before participation, respondents received an explanation of the study and provided informed consent. Body mass index (BMI) was then measured by recording participants' height and weight.

Data Analysis

Univariate analysis was used to describe respondent characteristics (age, gestational age, parity, and BMI) as well as the mean scores of physical activity and low back pains. Prior to analysis, data were checked for completeness, consistency, and accuracy. Missing or incomplete responses were reviewed, and outliers or data entry errors were identified and corrected to ensure data quality. Bivariate analysis was conducted to examine associations between independent variables and low back pain using non-parametric tests, as the data were not normally distributed. The Mann-Whitney U test was applied for two-group comparisons, the Kruskal-Wallis test for comparisons involving more than two groups, and Spearman rank correlation for associations between numeric variables. A p -value ≤ 0.05 was considered statistically significant.

RESULTS

Participant Demographics

Table 1. Participants' Demographic Characteristics (n=111)

Characteristics	Frequency	Percentage
Education		
Elementary School	7	6.3
Junior High School	4	3.6
Senior High School	62	55.9
College	37	33.3
Postgraduate	1	0.9
Occupation		
Housewife	90	81.1
Private Sector	13	11.7
Businessman	1	0.9
Civil Servant	7	6.3
Birth History		
Normal pervaginame	52	46.8
<i>Sectio Caesarea</i> (SC)	30	27.0
None	29	26.1
Age		
High risk (<20 and >35 y.o)	21	18.9
Low risk (20-35 ty.o)	90	81.1
Pregnancy Trimester		
1 st Trimester	33	29.7
2 nd Trimester	41	36.9
3 rd Trimester	37	33.3
Parity		
Low (≤ 3)	99	89.2
High (> 3)	12	10.8

BMI		
Underweight (<18,5)	9	8.1
Normal (18,5-24,9)	42	37.8
Overweight (25-29,9)	43	38.7
Obesity (≥30)	17	15.3
Total	111	100

More than half of the respondents (55.9%) had completed senior high school as their highest level of education. The majority (81.1%) were housewives, and most (81.1%) were within the non-risk age category. The majority (89.2%) had low parity (<3). Almost half (46.8%) reported a history of vaginal delivery. Regarding pregnancy status, more than one-third (36.9%) were in the second trimester. In terms of nutritional status, more than one-third (38.7%) were classified as overweight based on BMI (Table. 1).

Physical Activity

Table 2. Physical Activity Means Score (N=111)

Variable	Mean	Median	Min-Max	SD
Physical Activity	157.76	111.00	16-801	137.058

The mean physical activity score of pregnant women was 157.76 (SD = 137.06), with a median of 111.00, ranging from 16 to 801.

Low Back Pain

Table 3. Low Back Pain Means Score (N=111)

Variable	Mean	Median	Min-Max	SD
Low back Pain	9.71	9.00	3-20	3.652

The mean Low Back Pain (RMDQ) score was 9.71 (SD = 3.65), with a median of 9.00, ranging from 3 to 20.

Association of Age, Gestational Ages, Parity, Physical Activity, BMI with Low Back Pain

Table 4. Bivariate Analysis of Factors Associated with Low Back Pain Among Pregnant Women (N = 111)

Variable	n	Test statistic	Mean rank / r	p	Result
Maternal age		Mann-Whitney U = 529.00	75.81 (risk) vs. 51.38 (non-risk)	.002	Significant
Gestational age		Kruskal-Wallis H = 8.14	44.18 (T1), 56.44 (T2), 66.05 (T3)	.017	Significant
Parity		Mann-Whitney U = 141.00	93.75 (high) vs. 51.42 (low)	< .001	Significant
Body mass index		Kruskal-Wallis H = 7.33	45.44 (underweight), 52.35 (normal), 54.44 (overweight), 74.56 (obese)	.062	Not significant
Physical activity		Spearman's ρ = .141	-	.140	Not significant

Note. T1 = Trimester I; T2 = Trimester II; T3 = Trimester III. Significance level set at $p \leq .05$

The bivariate analysis showed that several factors were significantly associated with low back pain among pregnant women. Maternal age was significantly associated with low back pain (Mann-Whitney U = 529.00, $p = .002$), with higher mean rank observed in the risk age group compared to the non-risk group. Gestational age also demonstrated a significant difference (Kruskal-Wallis H = 8.14, $p = .017$), with mean rank scores increasing from the first trimester to the third trimester, indicating a higher

level of low back pain in later stages of pregnancy. Similarly, parity was significantly associated with low back pain (Mann-Whitney $U = 141.00$, $p < .001$), where women with higher parity had greater mean rank scores than those with lower parity. In contrast, body mass index (BMI) was not significantly associated with low back pain (Kruskal-Wallis $H = 7.33$, $p = .062$), although a trend of higher mean rank was observed among obese participants. Physical activity also showed no significant correlation with low back pain (Spearman's $\rho = .141$, $p = .140$).

DISCUSSION

Profile of Pregnant Women: Demographics, Physical Activity and Low Back Pain Patterns

This study showed that most pregnant women were in the low-risk age range of 20-35 years (81.1%), with nearly half (36.9%) in the second trimester. The majority (89.2%) had low parity (<4), and almost half (38.7%) were categorized as overweight. These findings are consistent with general maternal demographic profiles in Indonesia.

The average physical activity score was 157.76 MET-hours/week, and household activities contributing the most significant portion (97.91 MET-hours/week). While, exercise contributed minimally (7.51 MET-hours/week). It indicating that domestic task remained the primary source of energy expenditure among pregnant women in Padang, West Sumatra. Unfortunately, household activities carried out almost all the time can disrupt the body's biomechanical balance, which leads to increased complaints of lower back pain (Akshita, 2023; Conder et al., 2019).

Then, all respondents (100%) reported experiencing symptoms of LBP during pregnancy, with an average score of 9.71. The average number of lower back pain episodes for pregnant women was 9.71, with a median of 9.00, with a score range of 3-20. This study result aligns with research by Yolandini et al. (2024), which found that 100% of pregnant women experienced lower back pain of varying intensity. Importantly, most participants described the pain as intermittent (86.5%), suggesting a fluctuating pattern likely influenced by activity level, posture, and fatigue. In this study, almost all pregnant women (98.2%) frequently changed positions to improve back comfort. Most (83.8%) often lay down to rest due to back pain. While these strategies may provide temporary relief, they are largely passive and do not address underlying biomechanical or muscular factors. It indicates a gap in knowledge or access to more effective, evidence-based interventions, such as prenatal exercise programs, posture education, or core strengthening techniques.

Relationship between Demographics: Maternal Age, gestational Age, Parity with Lower Back Pain in Pregnant Women

Maternal age was significant associated with LBP in pregnant women. Pregnant women in the at-risk age group (lower than 17 or more than 35 years old) had a higher average lower back pain score compared to those in the non-risk age group. These results align with a previous study that found that pregnant women at risk experienced lower back pain more often than those at non-risk ages (Amin & Novita, 2022). Higher LBP score among young pregnant mother might cause multifaceted complaints like change in body mechanical balance, unmaturing musculoskeletal system and psychological factors (Bryndal et al., 2020). While mother over 35 years of age experience decreased physical condition and organ function, putting them at risk of experiencing lower back pain during pregnancy (Amjad & Awais, 2021).

There was significant difference in the level of lower back pain in each trimester of pregnancy. In the third trimester, the average back pain score was higher compared to the second trimester, and the first trimester. It indicates that the higher the gestational age, the higher the risk of lower back pain.



These results align with research reported that gestational age influences lower back pain in pregnant women (Backhausen et al., 2019; Berber & Satilmis, 2020; Bryndal et al., 2020). As gestational age increases, pregnant women tend to pull their shoulders and back when walking to maintain balance, causing discomfort. This condition makes the muscles work harder, thus triggering lower back pain (Akselîm et al., 2023; Amayri et al., 2023).

Furthermore, we found that significant association between parity and LBP among pregnant women. This underscores the crucial role of parity in lower back pain among pregnant women. The high-parity group exhibited a higher average lower back pain score than the low-parity group. This study's findings are in line with Bryndal et al. (2020) study, which also demonstrated a significant relationship between parity and lower back pain in pregnant women (Bryndal et al., 2020). The more pregnancies and deliveries a woman experience, the higher her risk of back pain, particularly in subsequent pregnancies due to weakened muscles (Backhausen et al., 2019). These results can be explained by the physiological changes that occur with repeated pregnancies and childbirth. Recurrent stretching of the abdominal and pelvic floor muscles can reduce core stability, leading to increased strain on the lumbar spine. In addition, cumulative hormonal influences, such as repeated exposure to relaxing, may contribute to ligament laxity and spinal instability, which can further increase susceptibility to pain (Manyozo et al., 2019). High parity has also been linked to inadequate recovery time between pregnancies, which may prevent full restoration of musculoskeletal strength before the next gestation. However, some previous studies have reported discrepancies, suggesting that parity may not directly predict back pain but instead acts as a confounding factor, influenced by maternal age, BMI, or occupational workload (Dudoniene & Kuisma, 2023). This suggests that while parity is an important factor, it should be interpreted in conjunction with other maternal characteristics and lifestyle factors.

The Relationship Between Body Mass Index and Low Back Pain in Pregnant Women

Our result revealed that no significant difference in the level of lower back pain based on BMI category. However, this study found that pregnant women with obesity had a higher average lower back pain score compared to mother with underweight), normal, and overweight. These results align with those of de Sousa et al. (2019) reporting that weight gain during pregnancy may not be a significant factor in the incidence of lower back pain. This finding contradicts Henky et al. (2022) study, which found a significant relationship between BMI during pregnancy and the incidence of lower back pain in pregnant women in Padang.

Most pregnant women with obese and overweight BMI were in their first and second trimesters. At this stage of pregnancy, although BMI was already high, the intensity of lower back pain had not reached its peak, as the most significant strain typically occurs in the third trimester when fetal growth accelerates and maternal posture changes more dramatically. This finding suggests that some women may have entered pregnancy with a high BMI, but its effect on back pain may only become more apparent in later stages.

These results highlight the complexity of the relationship between BMI and lower back pain. While BMI alone may not be a strong predictor, its interaction with gestational age and postural changes could be more important in understanding why some pregnant women experience more severe discomfort than others. Further longitudinal studies are needed to explore how pre-pregnancy BMI and weight gain across different trimesters influence the progression of lower back pain throughout pregnancy.

Relationship Between Physical Activity and Lower Back Pain in Pregnant Women



Physical activity did not have a statistically significant relationship with LBP among pregnant women. The transportation domain showed a weak but positive correlation with low back pain ($r = 0.229$, $p = 0.016$). These findings are aligning with results from Santos et al. (2021), which also found no association between physical activity (in terms of intensity or type) with low back pain during regardless of gestational age among pregnant women in Portugal.

The divergence of these results from some studies that found a significant protective effect of physical activity could be due to several factors (Boonpradit et al., 2024; Dipietro et al., 2019; Mota et al., 2015; Nagai-Tanima et al., 2022; Ribeiro et al., 2022). First, measurement differences—many studies use structured exercise interventions (such as supervised aerobic or strengthening programs) rather than self-reported general physical activity. For example, a meta-analysis found that randomized controlled trials of physical activity during pregnancy significantly reduced pain intensity and disability (Osinuga et al., 2021). Second, differences in sample size, intensity, frequency and type of physical activity may account for variation; lighter activities (e.g., walking, light housework) may not provide sufficient stimulus to influence back pain prevalence or severity. Third, cultural and contextual factors in Indonesia—such as typical forms of activity (household vs sports), workload, and rest practices—could moderate the effect of physical activity on pain outcomes. Lastly, recall bias and self-report limitations in our study might have attenuated the observed association; respondents may under- or over-estimate their actual activity levels.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design limits the ability to establish causal relationships between physical activity and low back pain among pregnant women. As both variables were measured at a single point in time, it remains unclear whether reduced physical activity contributes to low back pain or whether pain itself leads to decreased activity levels. Second, physical activity was assessed with self-reported measures, which are subject to recall bias and potential misreporting. Pregnant women may overestimate or underestimate their activity levels, particularly due to variations in daily routines and physical discomfort, which could affect the accuracy of the results. Third, the study was conducted in a single community health center, which may limit the generalizability of the findings to other settings with different socio-demographic characteristics, cultural contexts, or healthcare access. Despite these limitations, the findings provide valuable initial insights into the relationship between physical activity and low back pain during pregnancy. Future research using longitudinal designs, more diverse populations is needed to better understand causal pathways and to inform the development of targeted interventions in maternal healthcare settings.

CONCLUSION

This study revealed that the majority of pregnant women at the Belimbing Community Health Center were within the non-risk age group, predominantly in the second trimester, had low parity, and were classified as overweight. The mean physical activity level was 157.77 METs-hours/week, while the average lower back pain score was 9.71. Significant associations were identified between maternal age, gestational age, and parity with lower back pain. In contrast, body mass index (BMI) and physical activity were not significantly associated with LBP. These findings highlight the importance of targeted education and counseling by health professionals, particularly nurses, regarding the risk factors and management of lower back pain during pregnancy. Pregnant women should be encouraged to limit prolonged transportation-related activities and to engage in regular light physical activities, such as walking, pregnancy exercise, or stretching, to improve back muscle strength and alleviate discomfort. Maintaining appropriate gestational weight gain and understanding the implications of



parity and pregnancy timing are also essential. Early consultation with healthcare providers is recommended when back pain becomes severe or persistent.

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REFERENCES

- AkseliM, S., KÖSeoĞLu, B. F., AkseliM, B., & DoĞAn, A. (2023). Is There a Significant Difference between Pregnancy Related Lumbopelvic Pain Subtypes in Terms of Pain Characteristics, Fatigue, Balance, Emotional and Functional Status, Health Related Quality of Life and Disability? *Fiziksel Tıp ve Rehabilitasyon Bilimleri Dergisi*, 26(2), 223-233. <https://doi.org/10.31609/jpmrs.2023-96003>
- Akshita, G. (2023). Factors Influencing Biomechanics during Pregnancy and Ergonomic Modifications to Alleviate Discomfort: A Descriptive Review. *Ergonomics International Journal*, 7(4), 1-5. <https://doi.org/10.23880/eoj-16000311>
- Amayri, A., Khalayli, N., Haj Ali, D., & Kudsi, M. (2023). Low back pain in a sample of Syrian pregnant women: A cross-sectional study. *Health Sci Rep*, 6(7), e1389. <https://doi.org/10.1002/hsr2.1389>
- Amin, M., & Novita. (2022). SENAM HAMIL UNTUK MENGURANGI NYERI PUNGGUNG BAWAH IBU TRIMESTER III. *JKM Jurnal Keperawatan Merdeka* <https://doi.org/10.36086/jkm.v2i1.1283>
- Amjad, F., & Awais, M. (2021). Risk Factors Associated with Low Back Pain among Pregnant Women in Pakistan.
- Arummega, M. N., Rahmawati, A., & Meiranny, A. (2022). Faktor-Faktor yang Mempengaruhi Nyeri Punggung Ibu Hamil Trimester III: Literatur Review. *Jurnal Ilmiah Kebidanan*. <https://doi.org/10.35316/oksitosin.v9i1.1506>
- Backhausen, M. G., Bendix, J. M., Damm, P., Tabor, A., & Hegaard, H. K. (2019). Low back pain intensity among childbearing women and associated predictors. A cohort study. *Women Birth*, 32(4), e467-e476. <https://doi.org/10.1016/j.wombi.2018.09.008>
- Berber, M. A., & Satilmis, I. G. (2020). Characteristics of Low Back Pain in Pregnancy, Risk Factors, and Its Effects on Quality of Life. *Pain Manag Nurs*, 21(6), 579-586. <https://doi.org/10.1016/j.pmn.2020.05.001>
- Boonpradit, R., Sudsaneha, W., Khuancharee, K., & Raungrongmorakot, K. (2024). Association of Low Back Pain Beyond Mid-Pregnancy with Maternal Physical Activity Prior to Pregnancy: A Cross-Sectional Study. *Journal of Health Science and Medical Research*, 42(3). <https://doi.org/10.31584/jhsmr.20241047>
- Bryndal, A., Majchrzycki, M., Grochulska, A., Glowinski, S., & Seremak-Mrozikiewicz, A. (2020). Risk Factors Associated with Low Back Pain among A Group of 1510 Pregnant Women. *J Pers Med*, 10(2). <https://doi.org/10.3390/jpm10020051>
- Caputo, E. L., Domingues, M. R., Bertoldi, A. D., Ferreira, P. H., Ferreira, M. L., Shirley, D., & da Silva, M. C. (2021). Are leisure-time and work-related activities associated with low back pain during pregnancy? *BMC Musculoskelet Disord*, 22(1), 864. <https://doi.org/10.1186/s12891-021-04749-w>
- Carvalho, M. E. C. C., Lima, L. C., Terceiro, C. A. d. L., Pinto, D. R. L., Silva, M. N., Cozer, G. A., & Couceiro, T. C. d. M. (2017). Low back pain during pregnancy. *Brazilian Journal of Anesthesiology (English Edition)*, 67(3), 266-270. <https://doi.org/10.1016/j.bjane.2015.08.014>
- Chasan-Taber, L., Schmidt, M. D., Roberts, D. E., Hosmer, D., Markenson, G., & Freedson, P. S. (2004). Development and validation of a Pregnancy Physical Activity Questionnaire. *Med Sci Sports Exerc*, 36(10), 1750-1760. <https://doi.org/10.1249/01.mss.0000142303.49306.0d>



- Conder, R., Zamani, R., & Akrami, M. (2019). The Biomechanics of Pregnancy: A Systematic Review. *J Funct Morphol Kinesiol*, 4(4). <https://doi.org/10.3390/jfmk4040072>
- de Sousa, V. P. S., Cury, A., Eufrasio, L. S., de Sousa, S. E. S., Coe, C. B., & de Souza Ramalho Viana, E. (2019). The influence of gestational trimester, physical activity practice and weight gain on the low back and pelvic pain intensity in low risk pregnant women. *J Back Musculoskeletal Rehabil*, 32(5), 671-676. <https://doi.org/10.3233/BMR-171006>
- Dipietro, L., Evenson, K. R., Bloodgood, B., Sprow, K., Troiano, R. P., Piercy, K. L., Vaux-Bjerke, A., Powell, K. E., & Physical Activity Guidelines Advisory, C. (2019). Benefits of Physical Activity during Pregnancy and Postpartum: An Umbrella Review. *Med Sci Sports Exerc*, 51(6), 1292-1302. <https://doi.org/10.1249/MSS.0000000000001941>
- Dudoniene, V., & Kuisma, R. (2023). Women's Knowledge and Perceptions of the Effect of Exercise during Pregnancy: A Cross-Sectional Study. *Int J Environ Res Public Health*, 20(3). <https://doi.org/10.3390/ijerph20031822>
- Fatmarizka, T., Ramadanty, R. S., & Khasanah, D. A. (2021). Pregnancy-Related Low Back Pain and The Quality of Life among Pregnant Women: A Narrative Literature Review. *JOURNAL OF PUBLIC HEALTH FOR TROPICAL AND COASTAL REGION (JPHTCR)*.
- Henky, J., Efriza, & Aprillia. (2022). The Relationship of Body Mass Index in Third Trimester of Pregnancy with Low Back Pain Incidence. *Scientific Journal*, 1(3). <https://doi.org/10.56260/sciena.v1i3.47>
- Manyozo, S. D., Nesto, T., Bonongwe, P., & Muula, A. S. (2019). Low back pain during pregnancy: Prevalence, risk factors and association with daily activities among pregnant women in urban Blantyre, Malawi. *Malawi Med J*, 31(1), 71-76. <https://doi.org/10.4314/mmj.v31i1.12>
- Mastiningsih, P., & Aswitami, G. A. P. (2018). Pengaruh Terapi Akupresur terhadap Nyeri Punggung Bawah pada Ibu Hamil TM III di Wilayah Kerja Puskesmas Abian Semal 1. *Strada Jurnal Ilmiah Kesehatan*, 7(2), 47-51. <https://doi.org/10.30994/sjik.v7i2.171>
- Mota, M. J., Cardoso, M., Carvalho, A., Marques, A., Sa-Couto, P., & Demain, S. (2015). Women's experiences of low back pain during pregnancy. *J Back Musculoskeletal Rehabil*, 28(2), 351-357. <https://doi.org/10.3233/BMR-140527>
- Nagai-Tanima, M., Aoyama, T., Yamashita, M., Umezaki, F., Hatanaka, H., Kato, N., Koshi, M., Chen, C. Y., Ishihara, M., Morino, S., Yamashiro, C., & Kawabe, R. (2022). Relationship between Physical Activity and Lumbopelvic Pain during Pregnancy: A Cross-Sectional Study. *Clinical and Experimental Obstetrics & Gynecology*, 49(9). <https://doi.org/10.31083/j.ceog4909209>
- Nazari, B., Zamani Esfahlani, M., Dorosti, A., & Mirzaei, F. (2020). Prevalence and Risk Factors for Low Back Pain in Primiparous Women Visiting Maternity Hospitals During Different Months of Pregnancy. *International Journal of Women's Health and Reproduction Sciences*, 8(4), 401-405. <https://doi.org/10.15296/ijwhr.2020.64>
- Osinuga, A., Hicks, C., Ibitoye, S. E., Schweizer, M., Fethke, N. B., & Baker, K. K. (2021). A meta-analysis of the association between physical demands of domestic labor and back pain among women. *BMC Womens Health*, 21(1), 150. <https://doi.org/10.1186/s12905-021-01294-5>
- Ribeiro, M. M., Andrade, A., & Nunes, I. (2022). Physical exercise in pregnancy: benefits, risks and prescription. *J Perinat Med*, 50(1), 4-17. <https://doi.org/10.1515/jpm-2021-0315>
- Sencan, S., Ozcan-Eksi, E. E., Cuce, I., Guzel, S., & Erdem, B. (2018). Pregnancy-related low back pain in women in Turkey: Prevalence and risk factors. *Ann Phys Rehabil Med*, 61(1), 33-37. <https://doi.org/10.1016/j.rehab.2017.09.005>
- Stratford, P. W., & Riddle, D. L. (2016). A Roland Morris Disability Questionnaire Target Value to Distinguish between Functional and Dysfunctional States in People with Low Back Pain. *Physiother Can*, 68(1), 29-35. <https://doi.org/10.3138/ptc.2014-85>
- Suryanti, Y., Lilis, D. N., & Harpikriati, H. (2021). Pengaruh Kompres Hangat terhadap Nyeri Punggung Ibu Hamil Trimester III di Puskesmas Sekernan Ilir Tahun 2020. *Jurnal Akademika Baiturrahim Jambi*, 10(1). <https://doi.org/10.36565/jab.v10i1.264>
- Yolandini, Y., Purnamasari, K. D., & Fatimah, S. (2024). Gambaran Nyeri Punggung Bawah pada Ibu Hamil Trimester II dan III di TPMB Elis Marlina. *Journal of Midwifery and Public Health*, 6(1). <https://doi.org/10.25157/jmph.v6i1.16129>